

New developments in the geology of the Canbelego region

Insights from geophysics, geochronology
and field mapping

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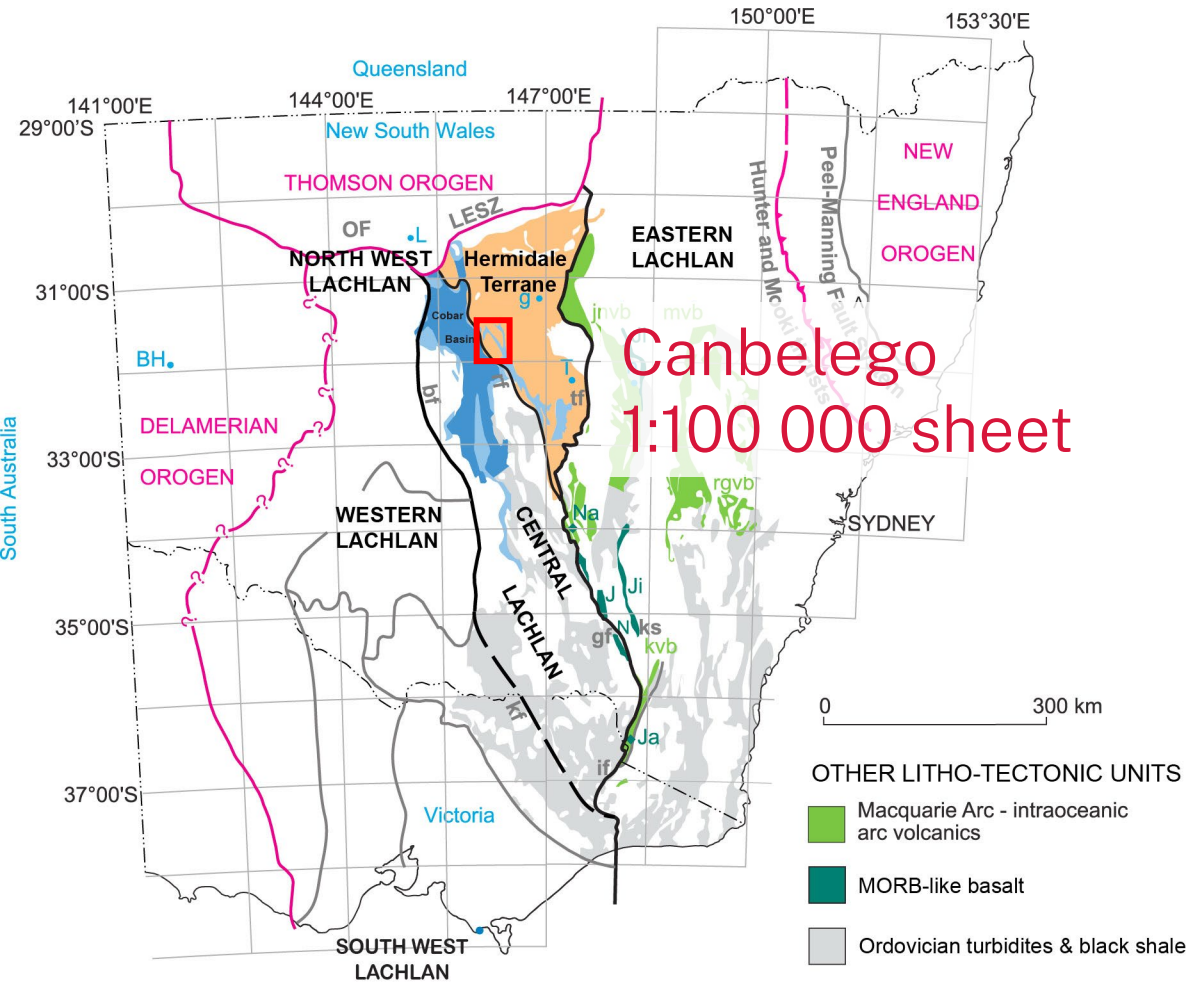


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1

Project overview

Regional geology

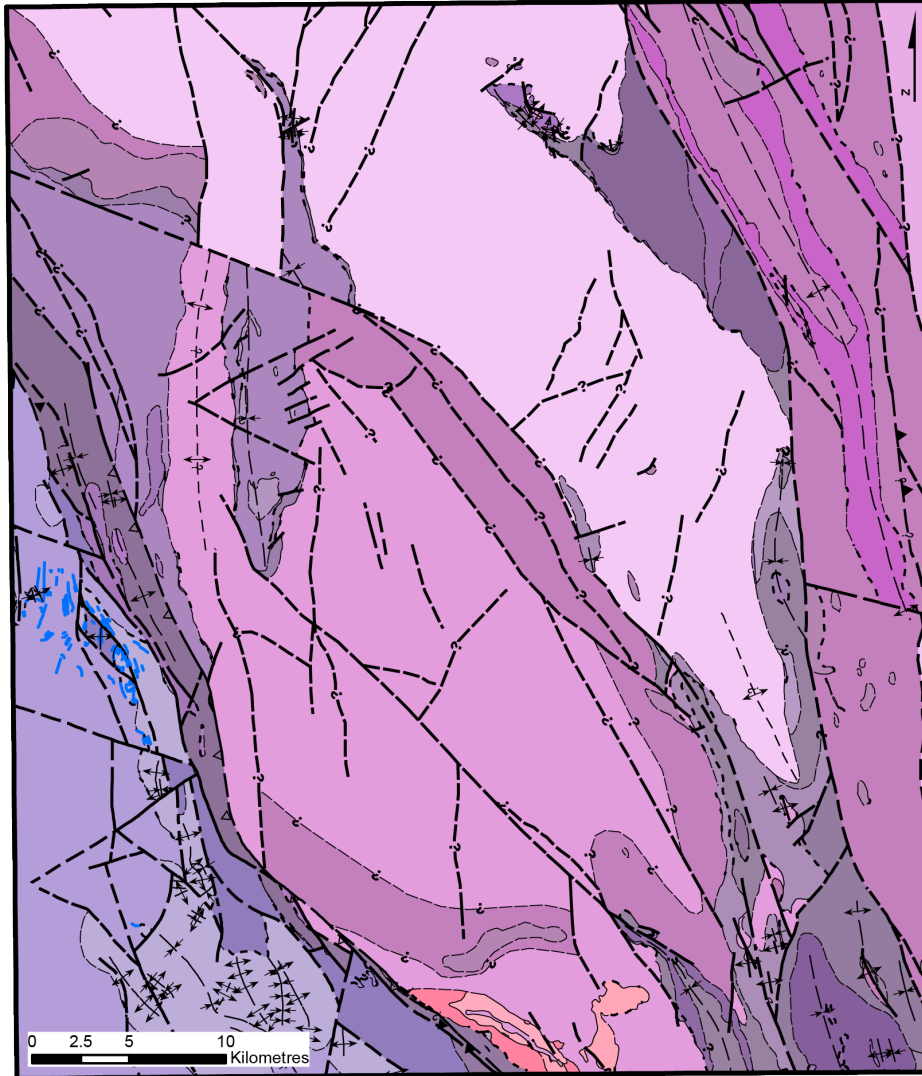


Orogens and structural subdivisions of Palaeozoic NSW modified from Glen et al. (2009, 2016).

Located southeast of Cobar in the northern part of the **Central Lachlan Orogen**

Takes in the western margin of the **Hermidale Terrane** bordering the **Cobar Superbasin**

Canbelego 1:100,000 map sheet

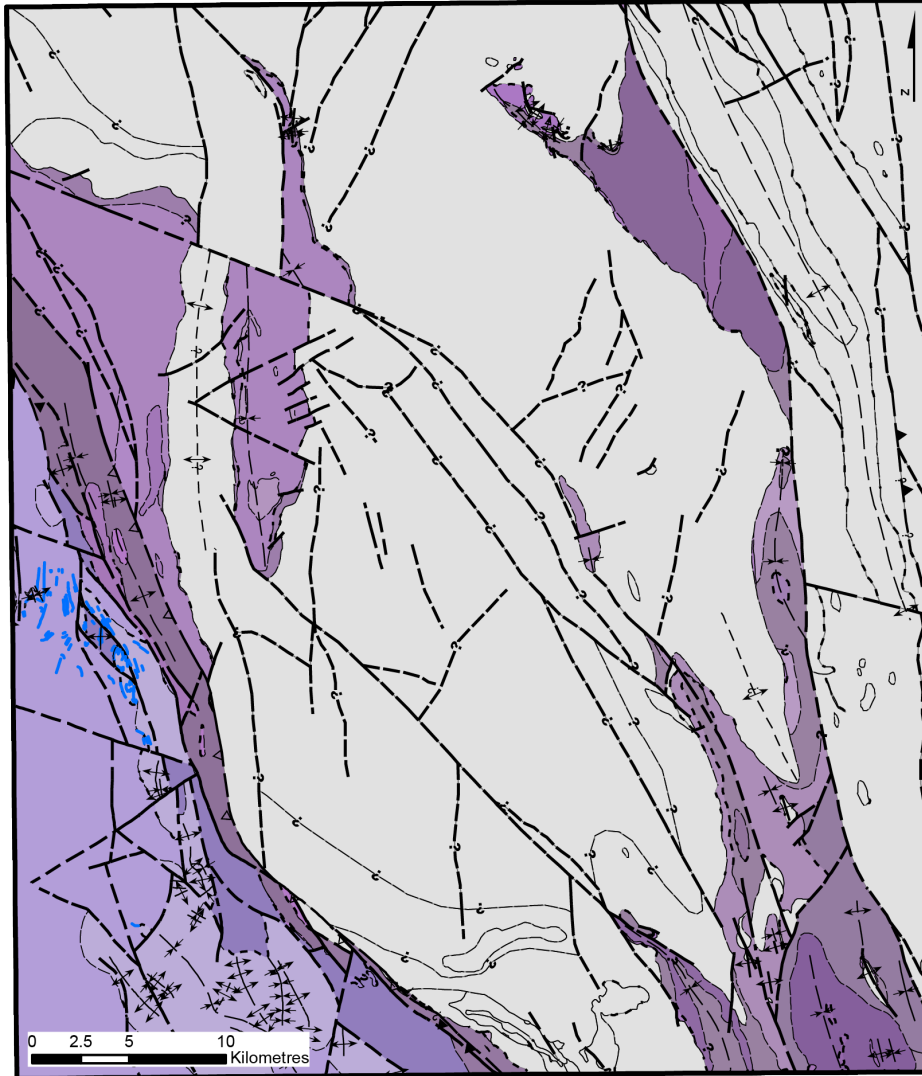


NSW Seamless Geology of the Canbelego 1:100,000 map sheet area (Colquhoun et al. 2023).

Geology comprises 2 main strato-tectonic units:

- Siluro–Devonian basin system (**Cobar Supergroup**) unconformably overlying
- Ordovician basement (**Girilambone Group**)

Canbelego 1:100,000 map sheet

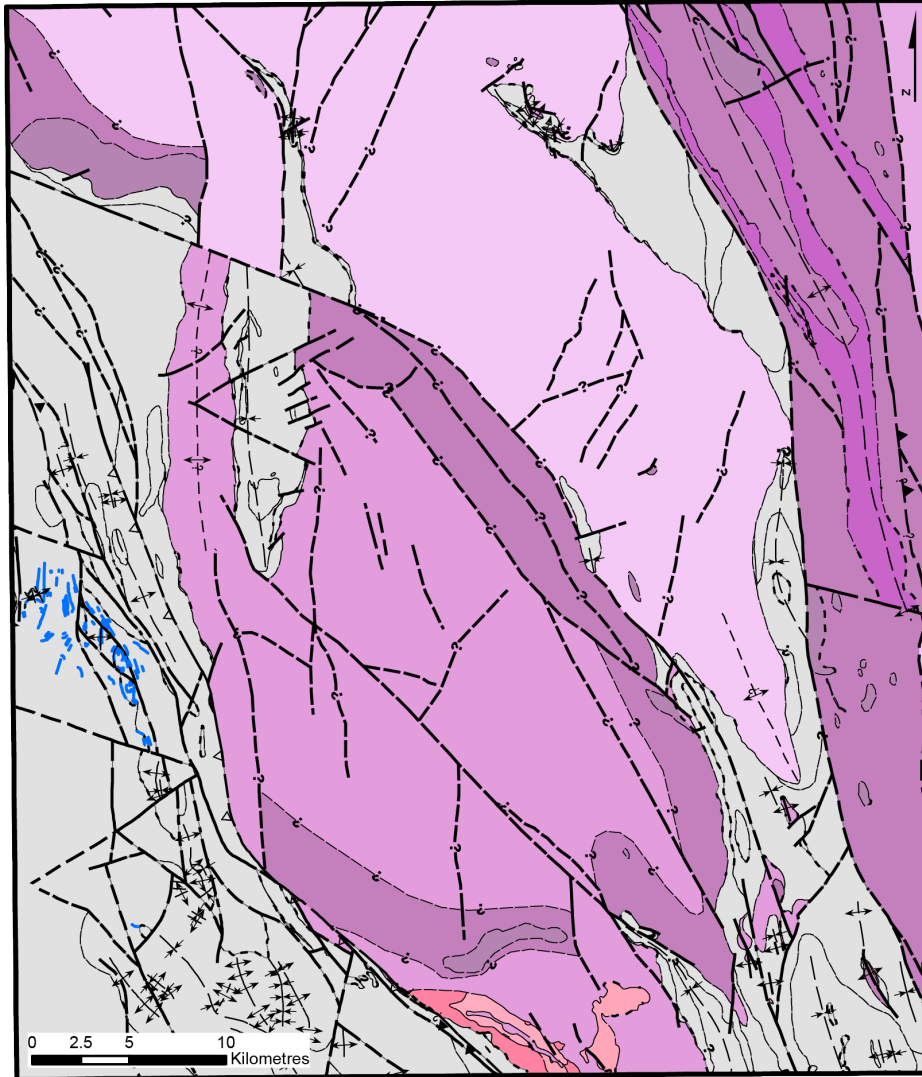


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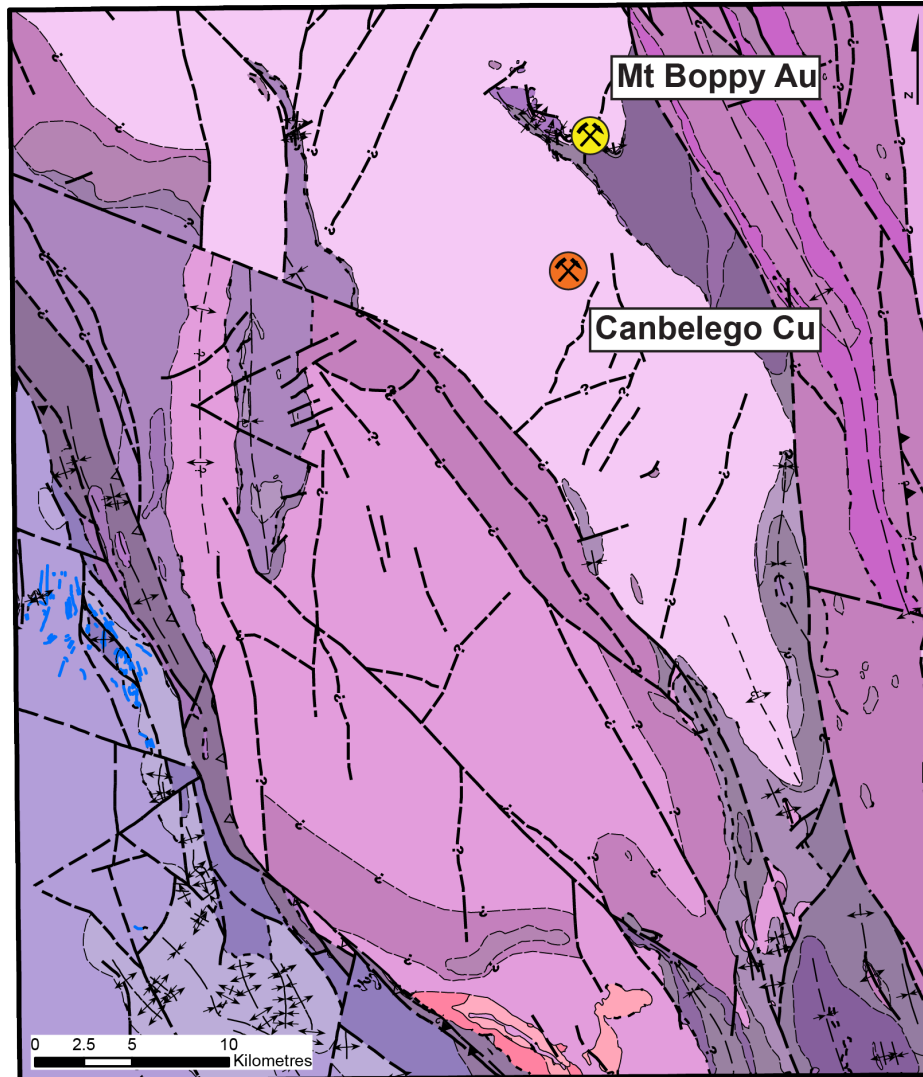


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Metallogenic associations

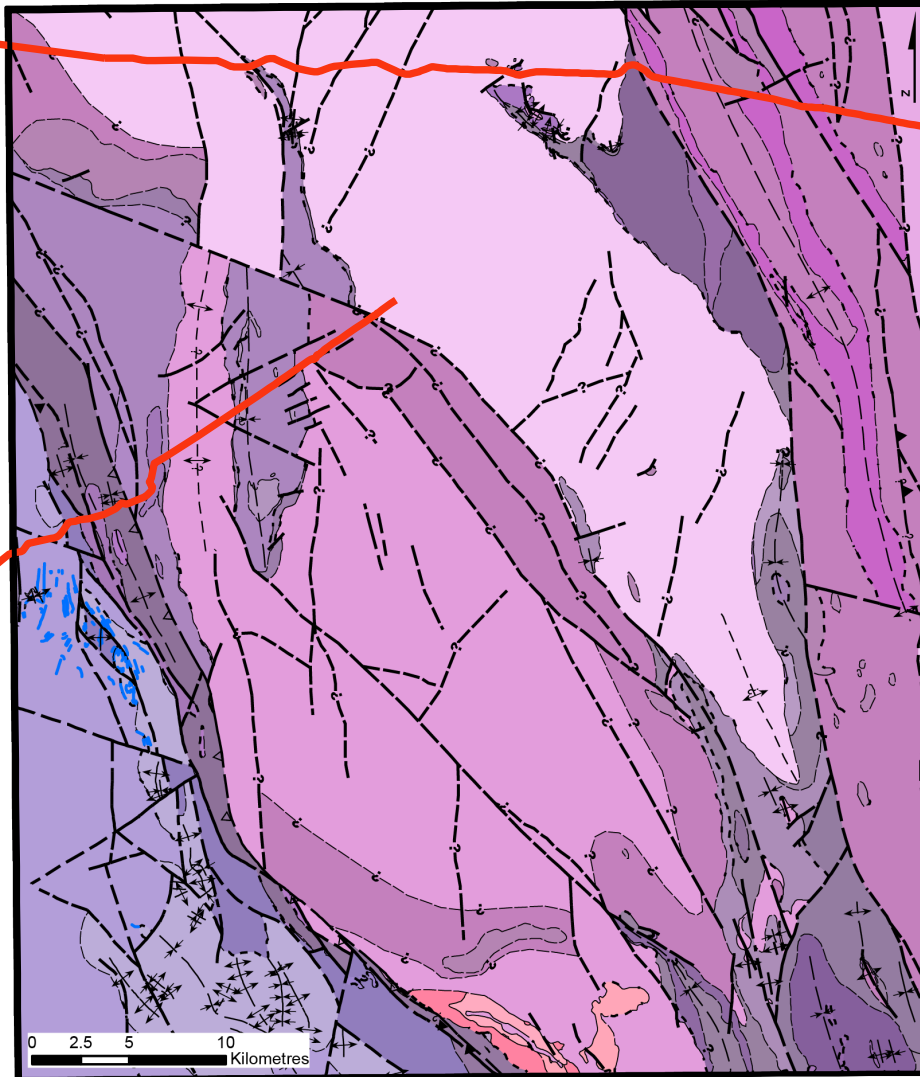


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Region of known mineral endowment and current exploration:

- **Au and base metal** deposits associated with the Cobar Supergroup (e.g. Mt Boppy Au Mine)
- **Girilambone-type Cu** deposits in the Ordovician basement (e.g. Canbelego Cu Mine)

Project aims



NSW Seamless Geology of the Canbelego 1:100,000 map sheet area (Colquhoun et al. 2023).

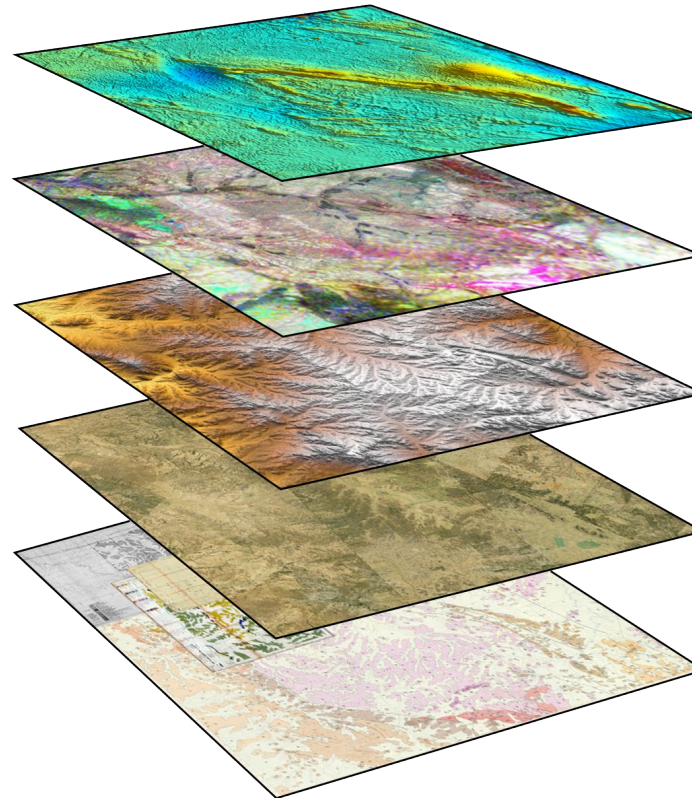
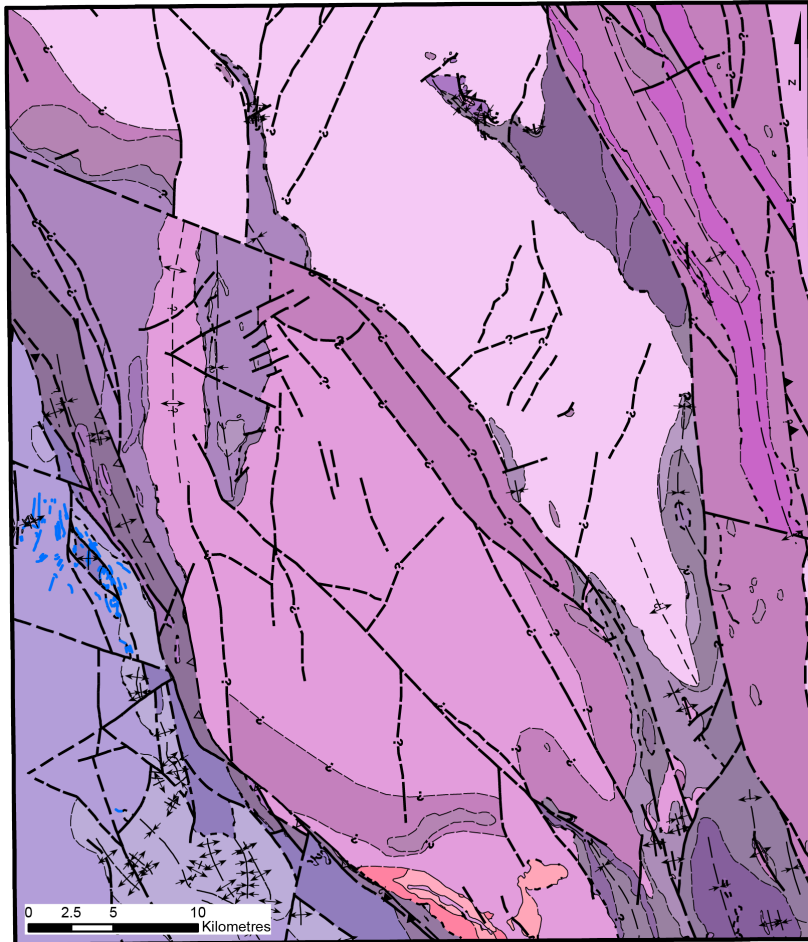
Existing maps produced without high-resolution geophysics and modern dating techniques

New solid geology interpretation developed to:

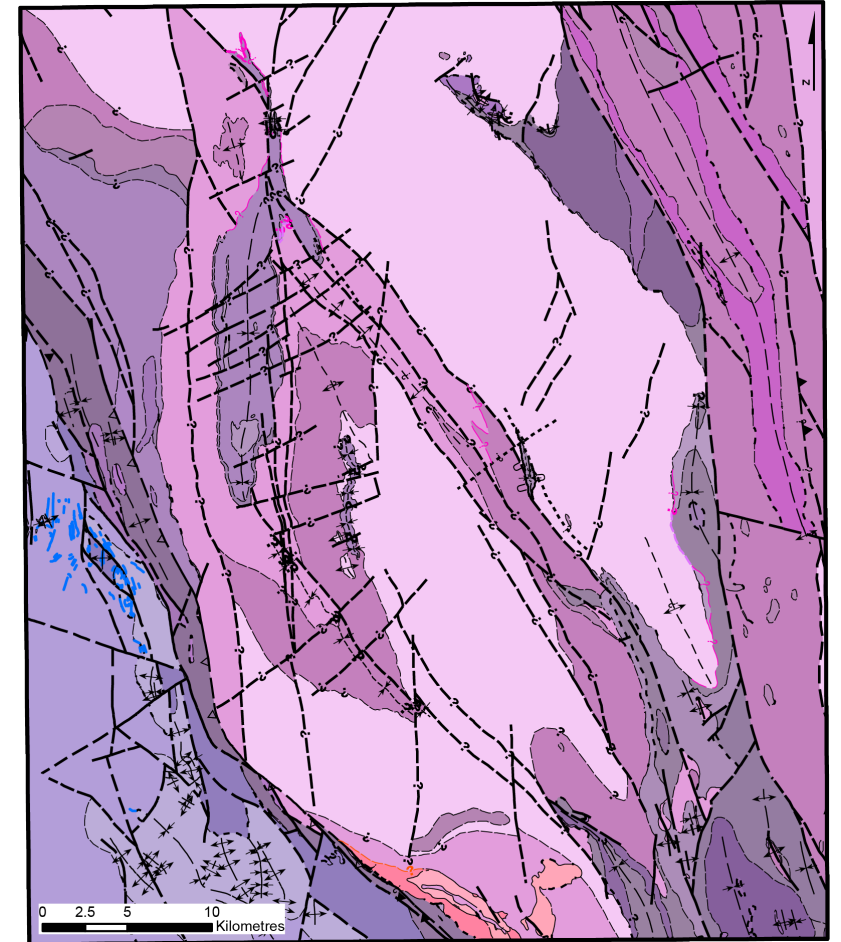
- improve geodynamic context of the regions mineral deposits
- complement interpretation of **Cobar–Yathong seismic survey**
- inform **MinEx CRC National Drilling Initiative** selection process in the Cobar Focus Area

Interpretation approach

Existing solid geology



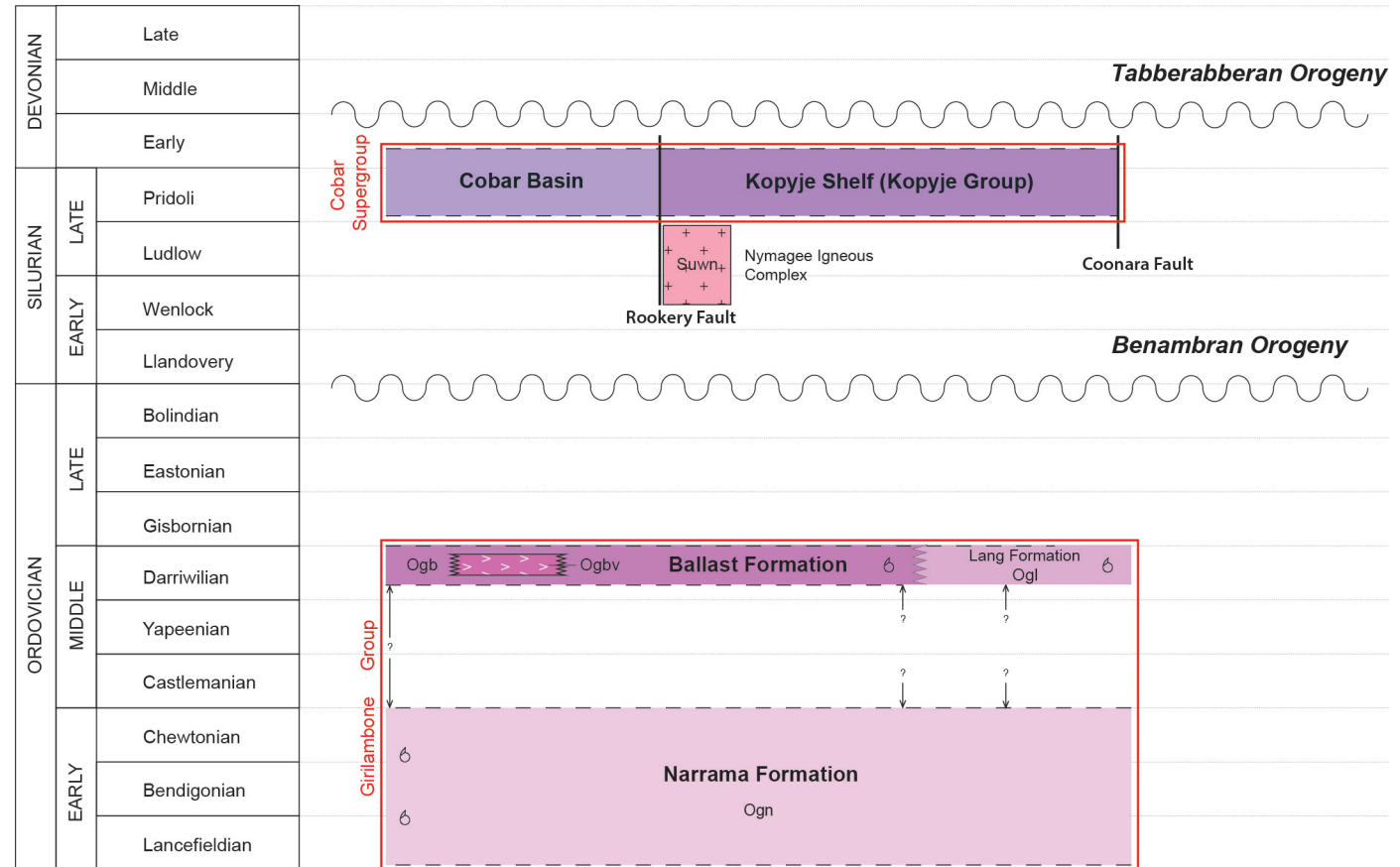
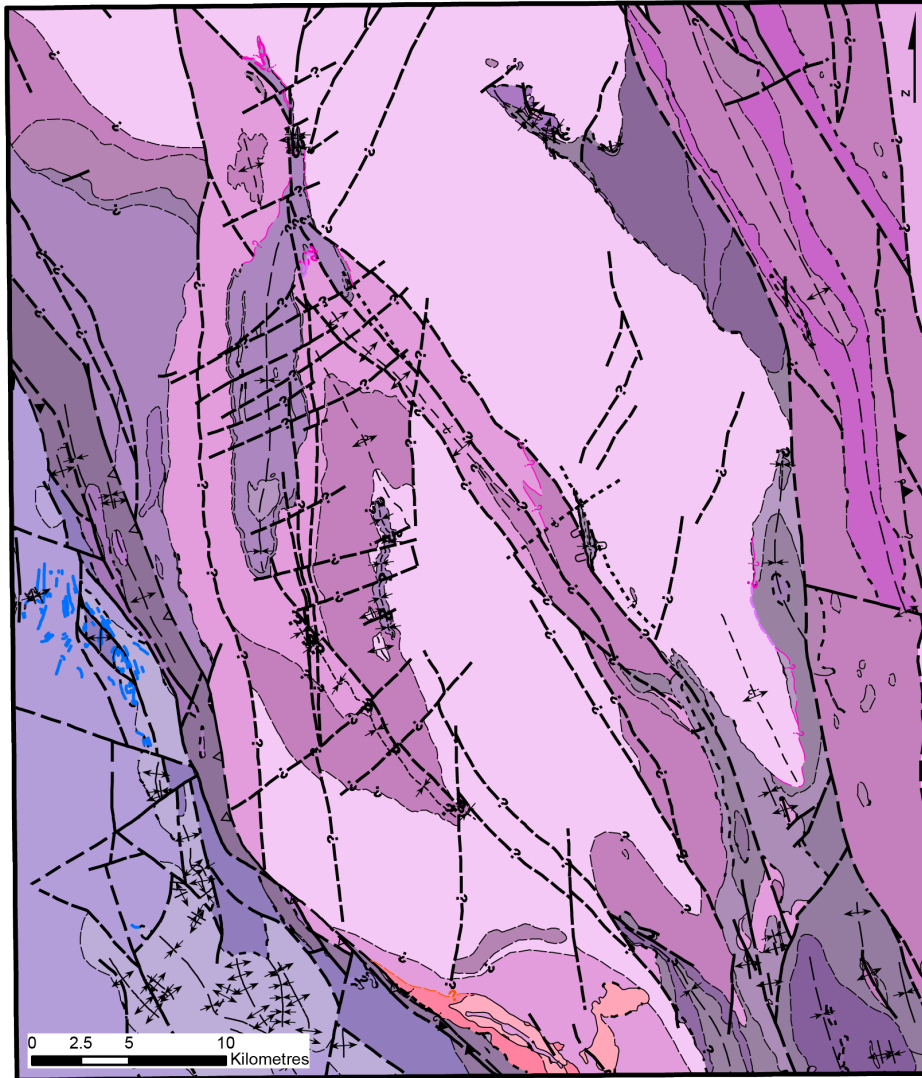
New solid geology



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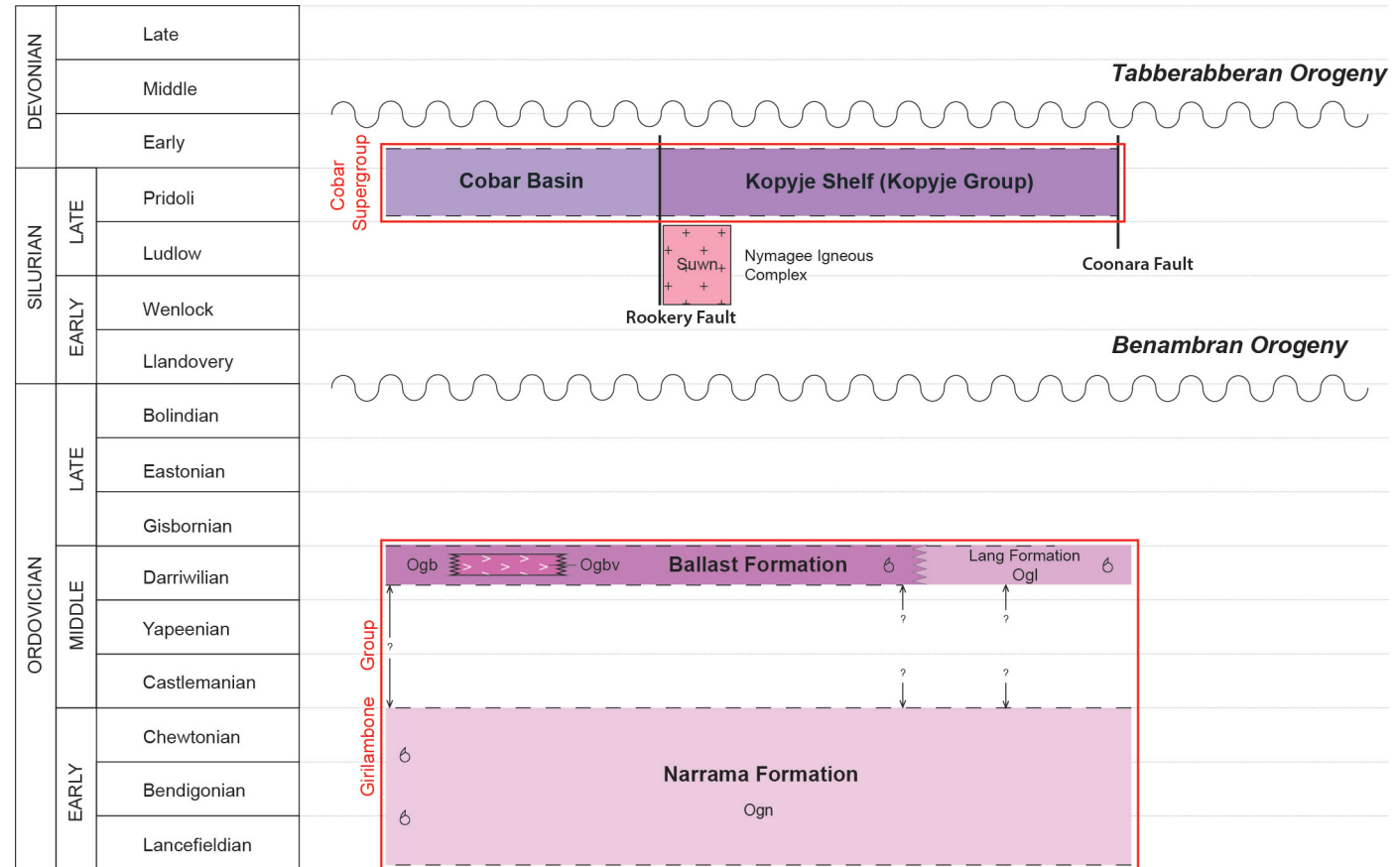
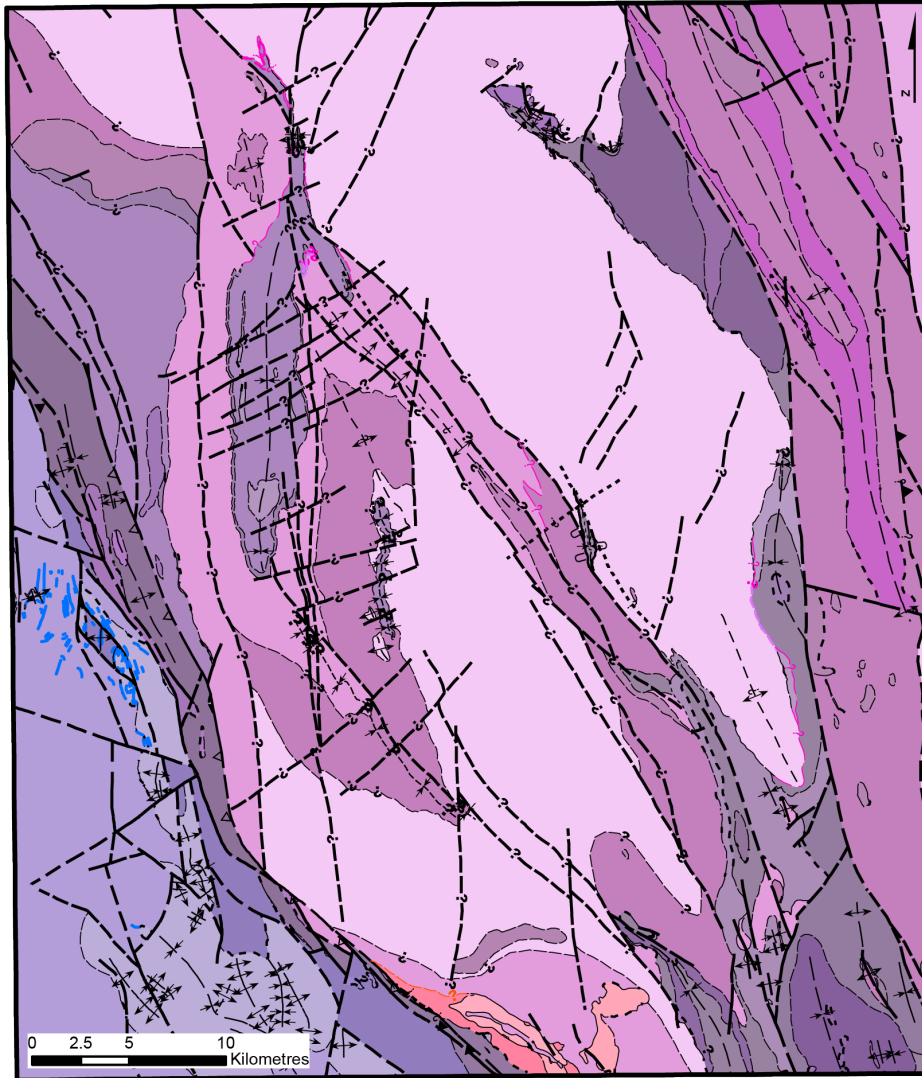
Local stratigraphy and deformation history

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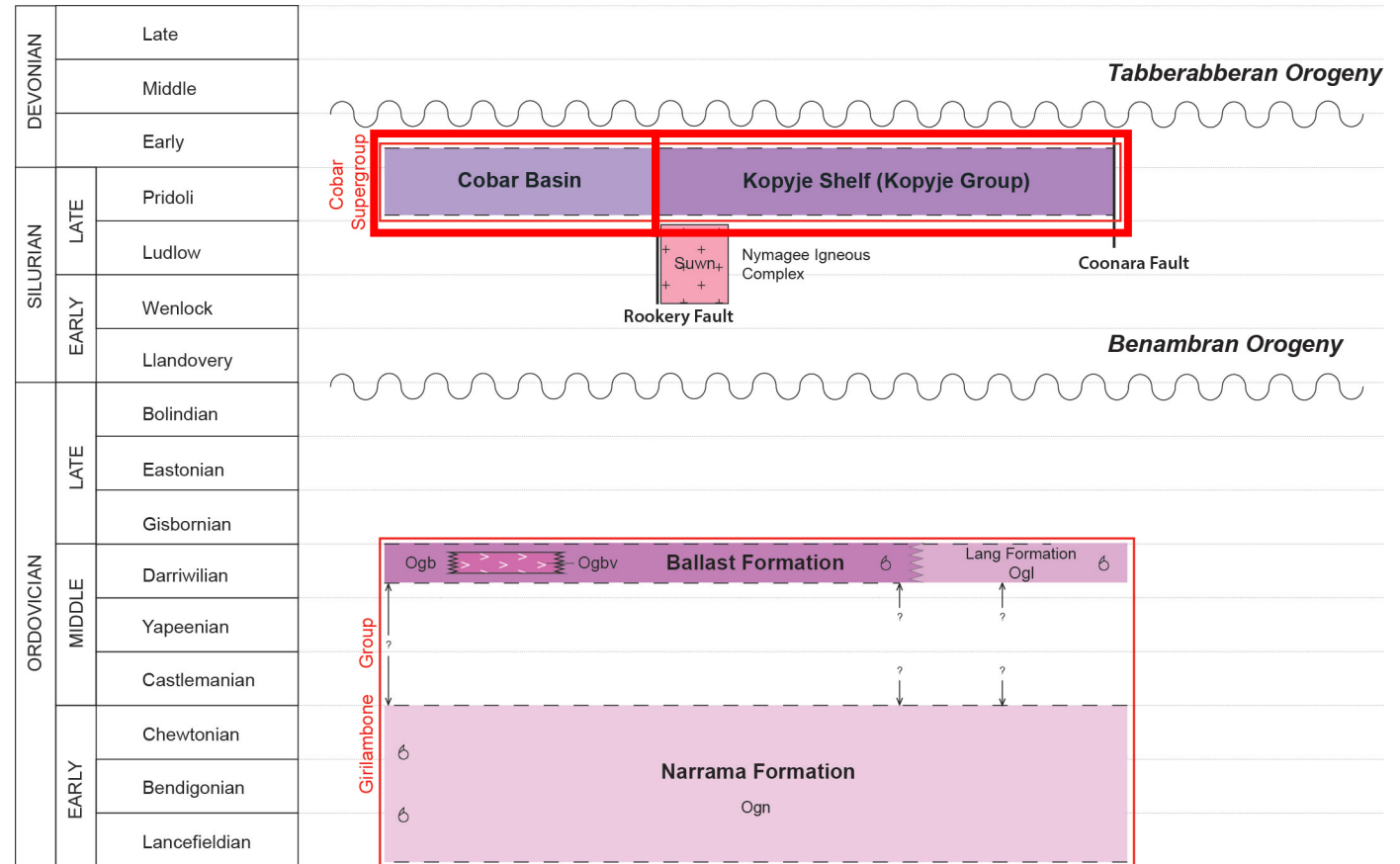
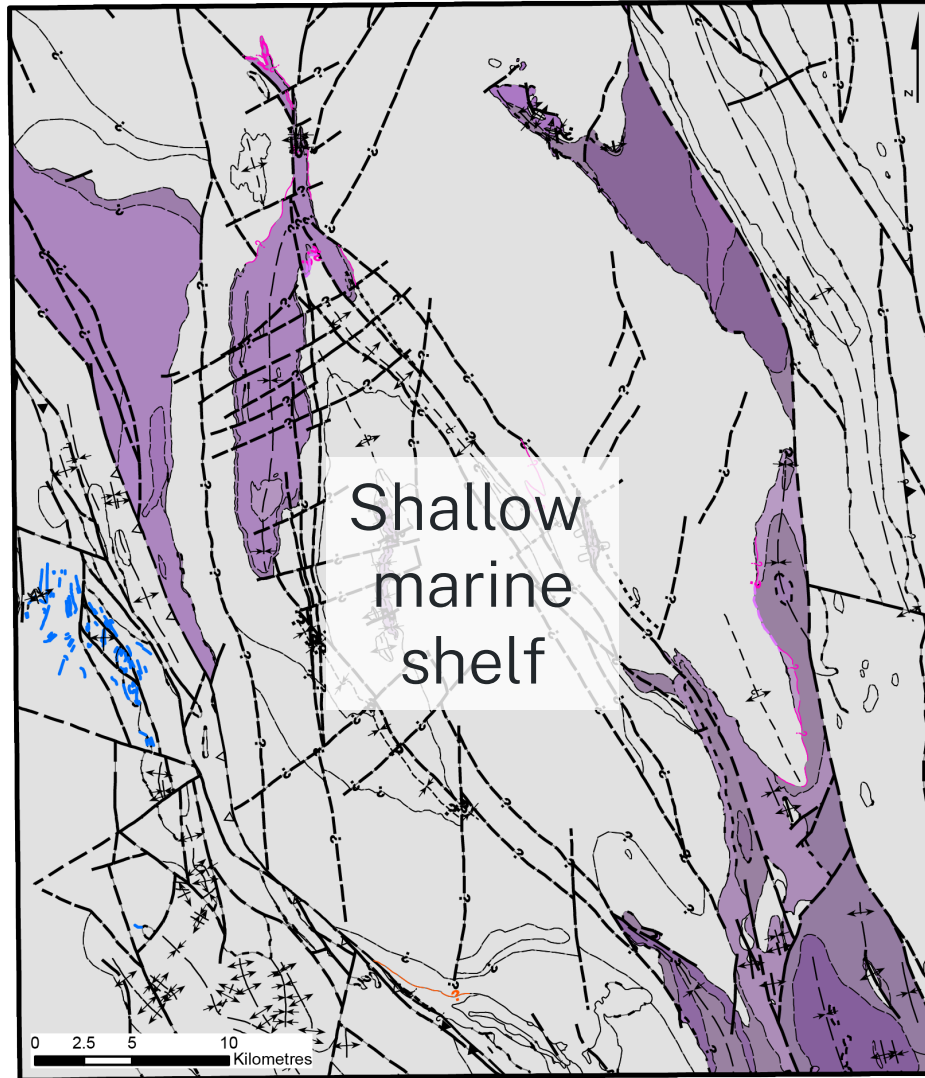
Time-space plot modified from Burton et al. (2012)

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Local stratigraphy and deformation history

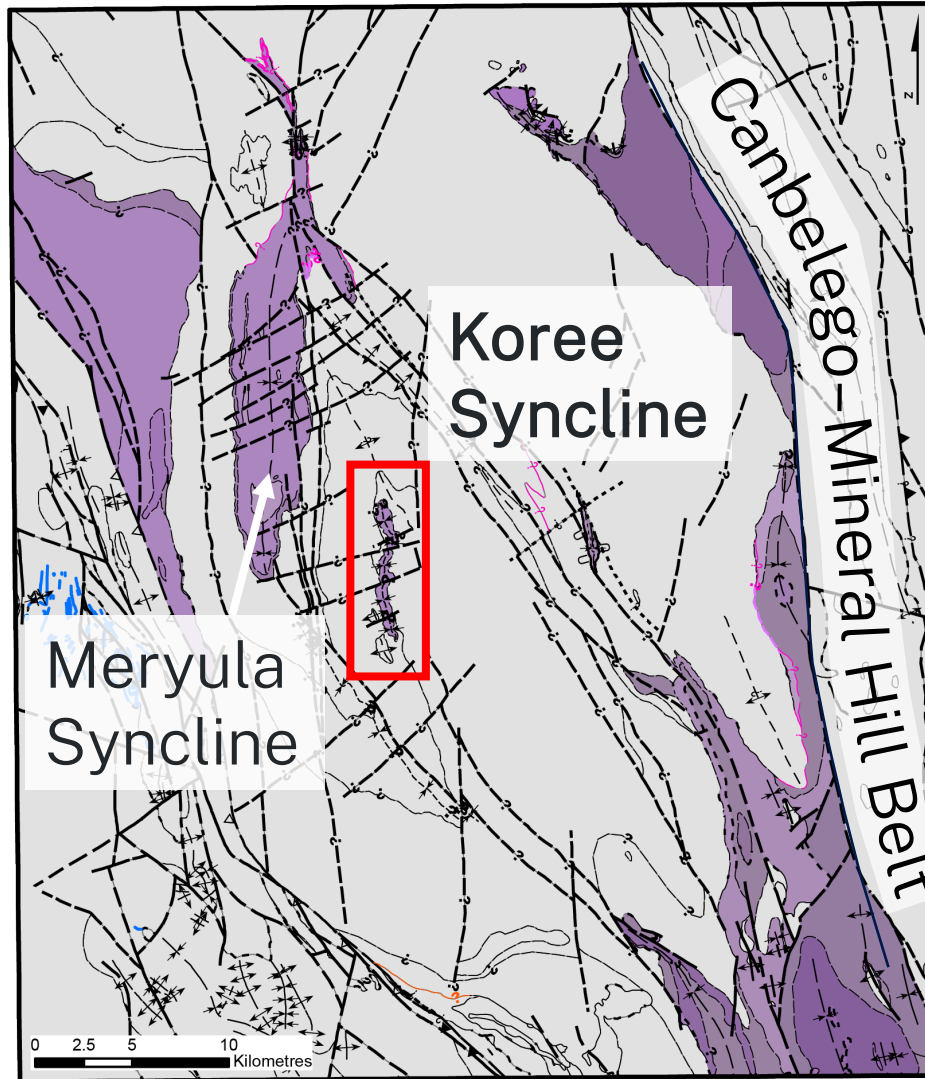


Time-space plot modified from Burton et al. (2012)

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Structural architecture

Tabberabberan structures

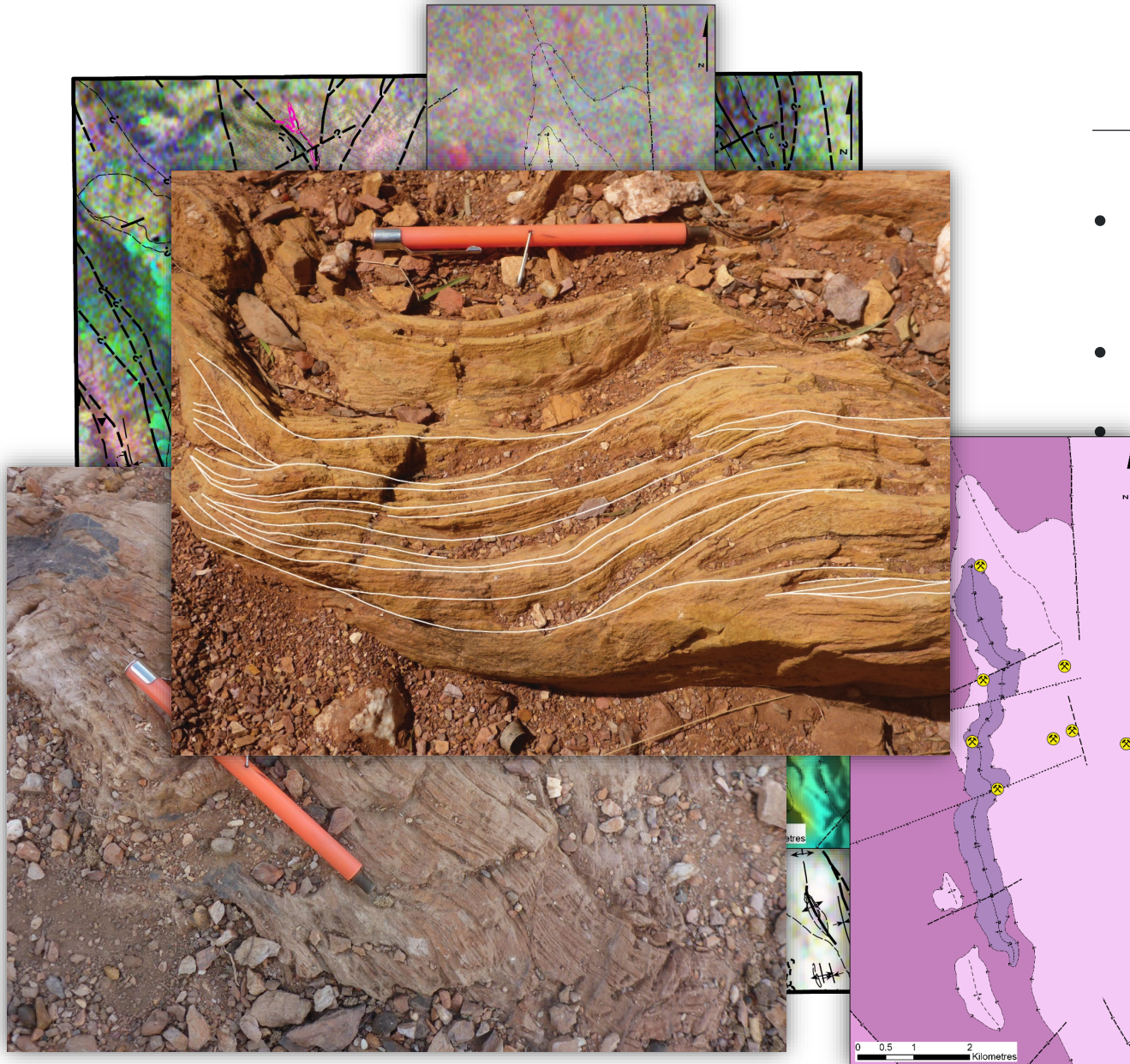


Macroscopic **folds** defined by the preserved distribution of the **Kopyje Group**

Small-scale, low amplitude, short wavelength folds relative to Benambran structures

- Canbelego–Mineral Hill Belt: north and north-northwest trending folds
 - Meryula Syncline: north–south trending folds
 - **Koree Syncline (new structure)**
-

Tabberabberan structures – Koree Syncline

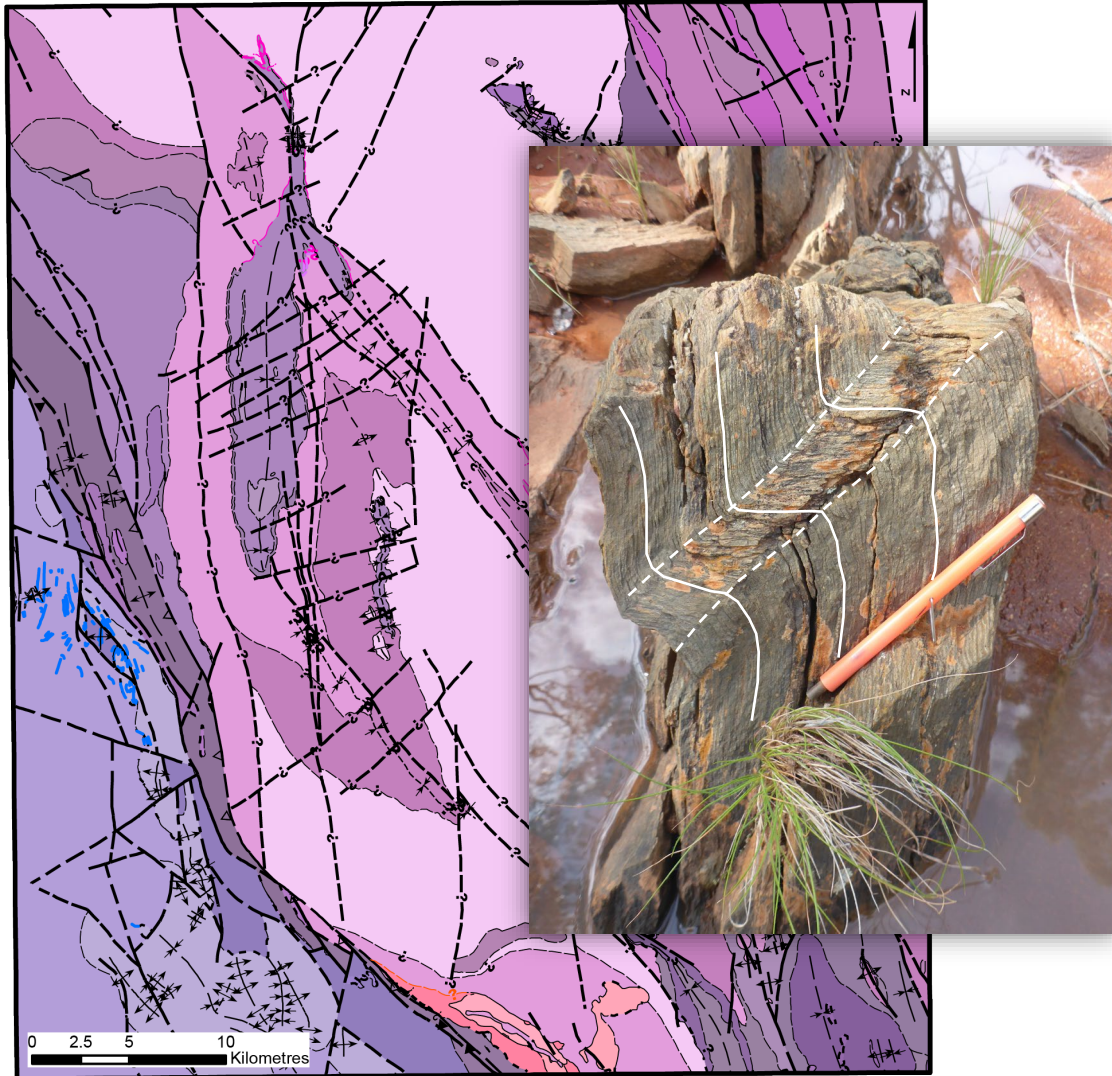


- North-south trending syncline keel developed parallel to Meryula Syncline
- Initially recognised from radiometric imagery
- Defined by cross-laminated quartz-sandstone and siltstone consistent with **shallow marine** setting of the **Kopyje Group**

Overprinted by ENE trending faults and kink folds

Known **Au deposits** spatially associated with late cross structures and unconformity with basement — i.e. **Mt Boppy-style**

Benambran structures

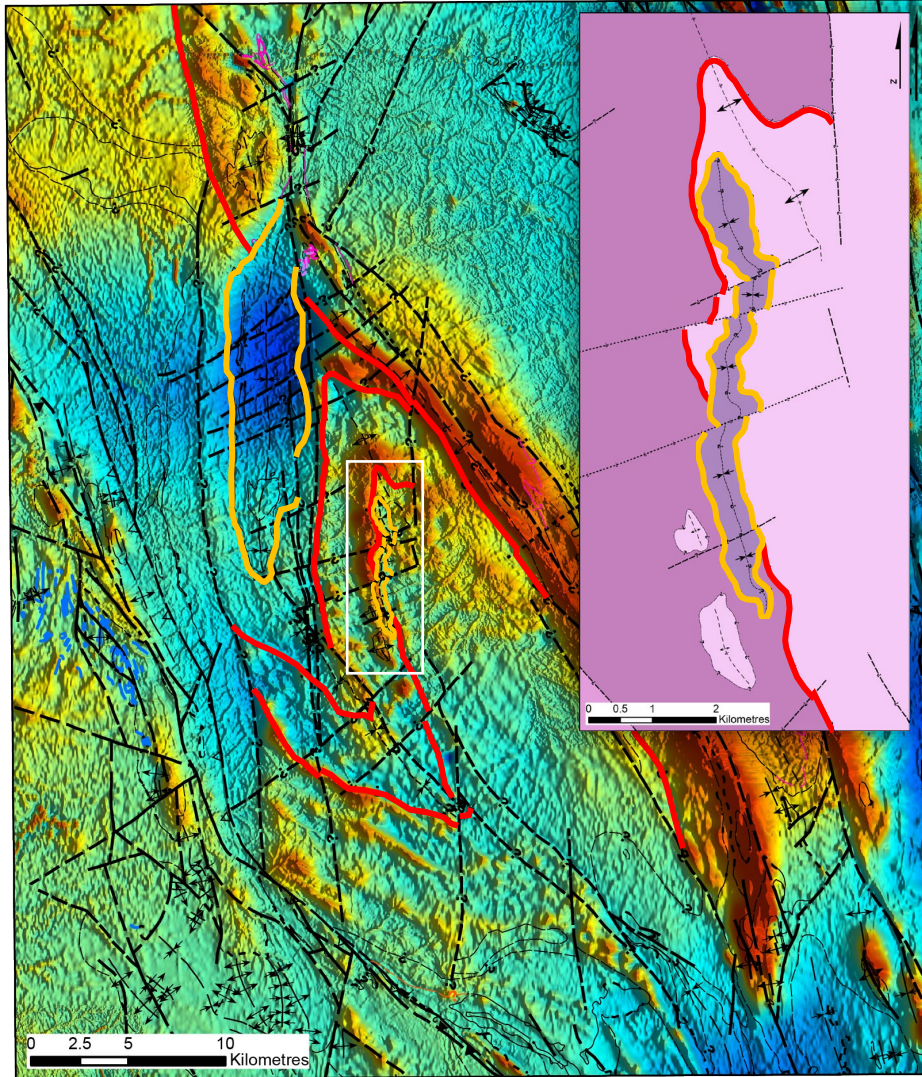


Harder to delineate due to:

- Complexity introduced by subsequent deformation
- Internal stratigraphy of the Girilambone Group incompletely mapped and validated regionally

Regional geophysics is helping to reveal the Benambran structures

Benambran structures



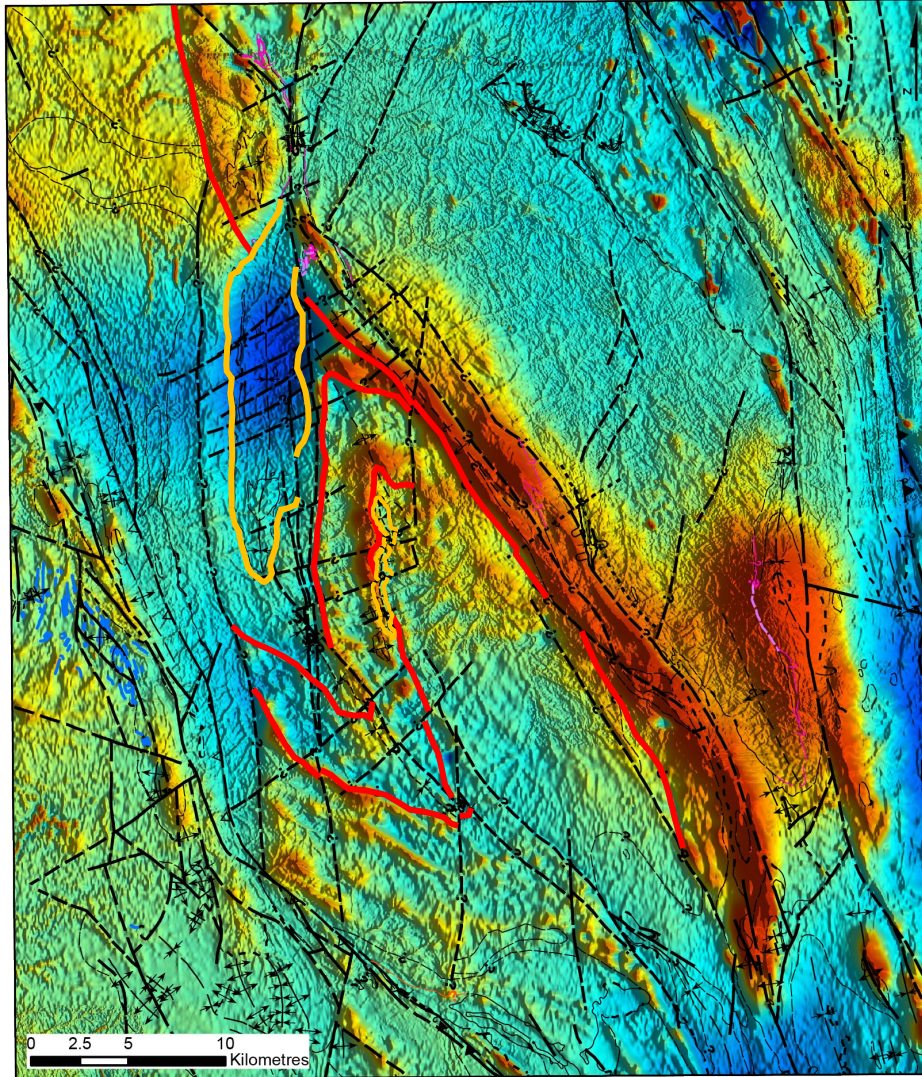
Revised linework overlying total magnetic intensity (reduced to pole) image.

Aeromagnetic imagery defines **large-scale** macroscopic **folds** and **faulting** in the Girilambone Group that predates the Kopyje Group (i.e. **Benambran Orogeny**)

Longer wavelength and higher amplitude compared to Tabberabberan folds

Northwest-southeast axial trace oblique to north-south trending Tabberabberan folds in Kopyje Group

Benambran structures



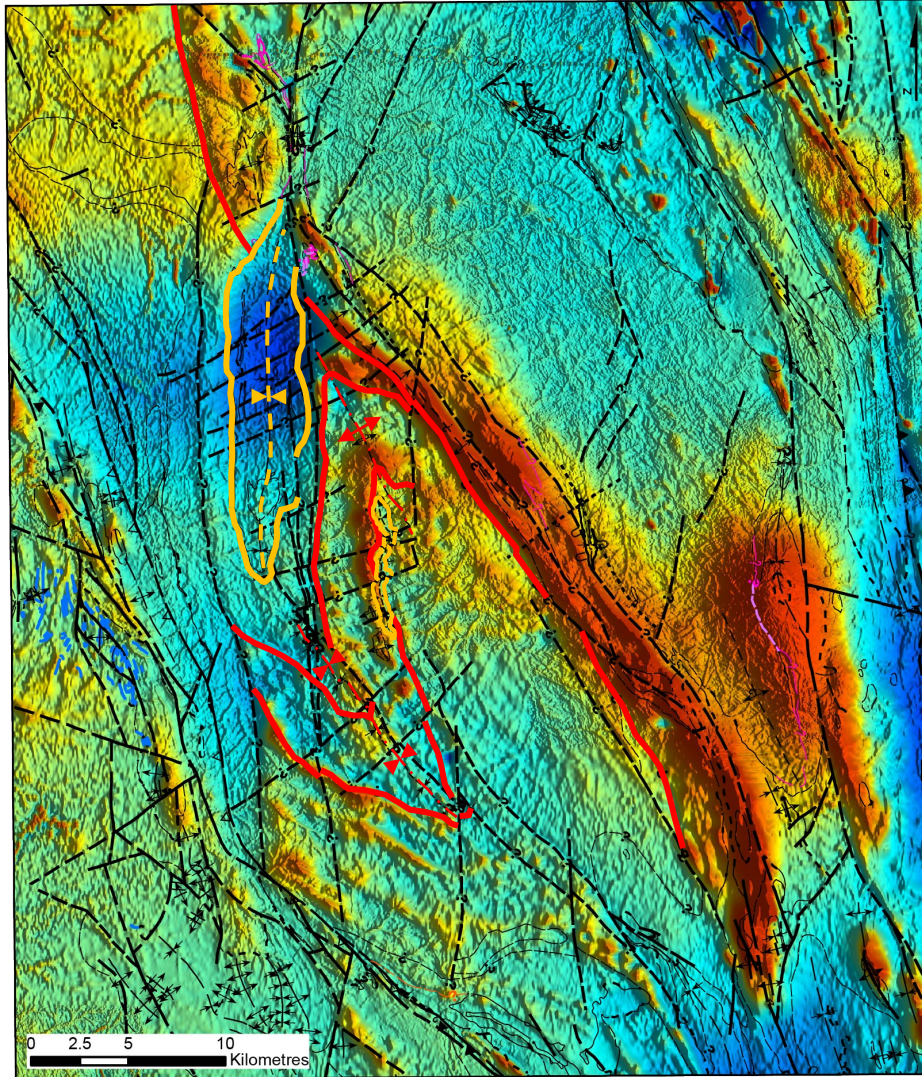
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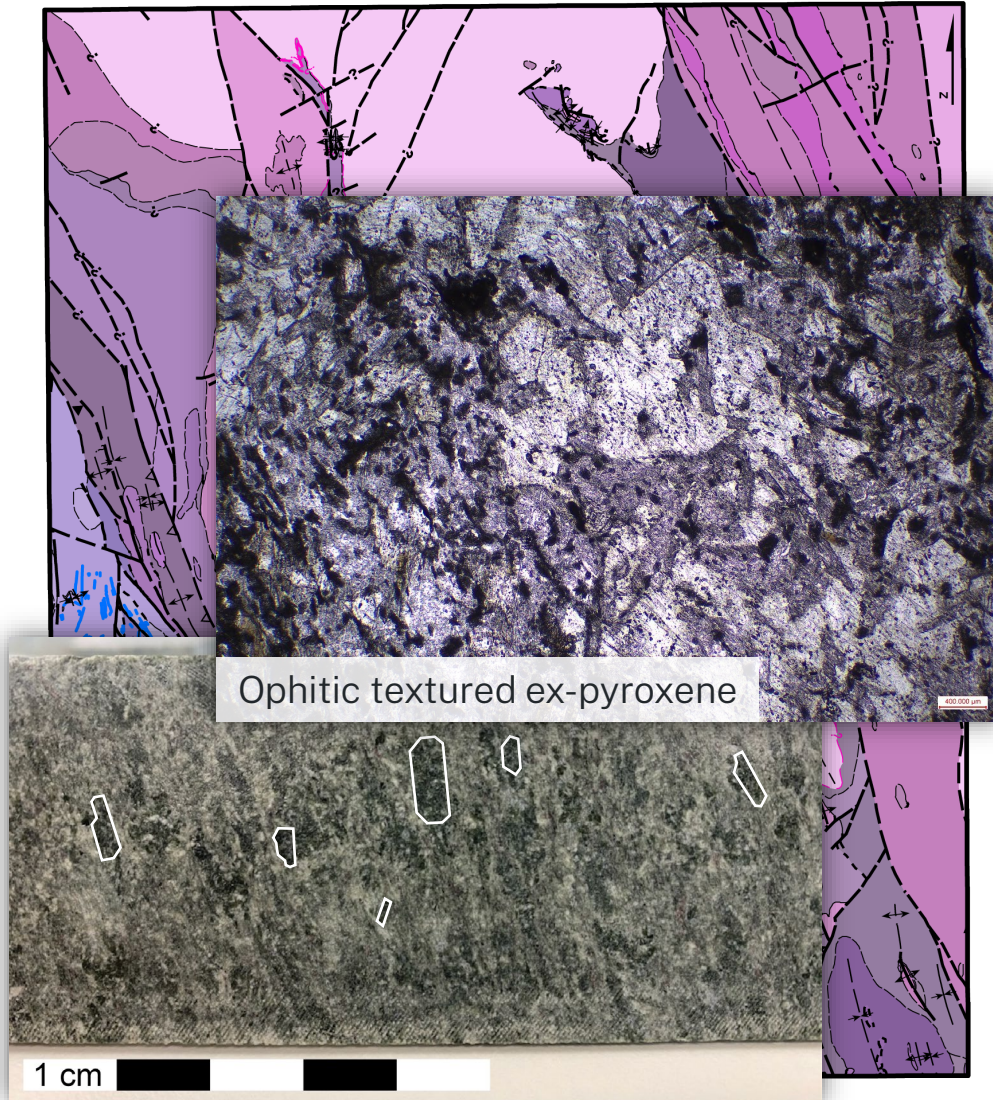
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Geochronological evidence

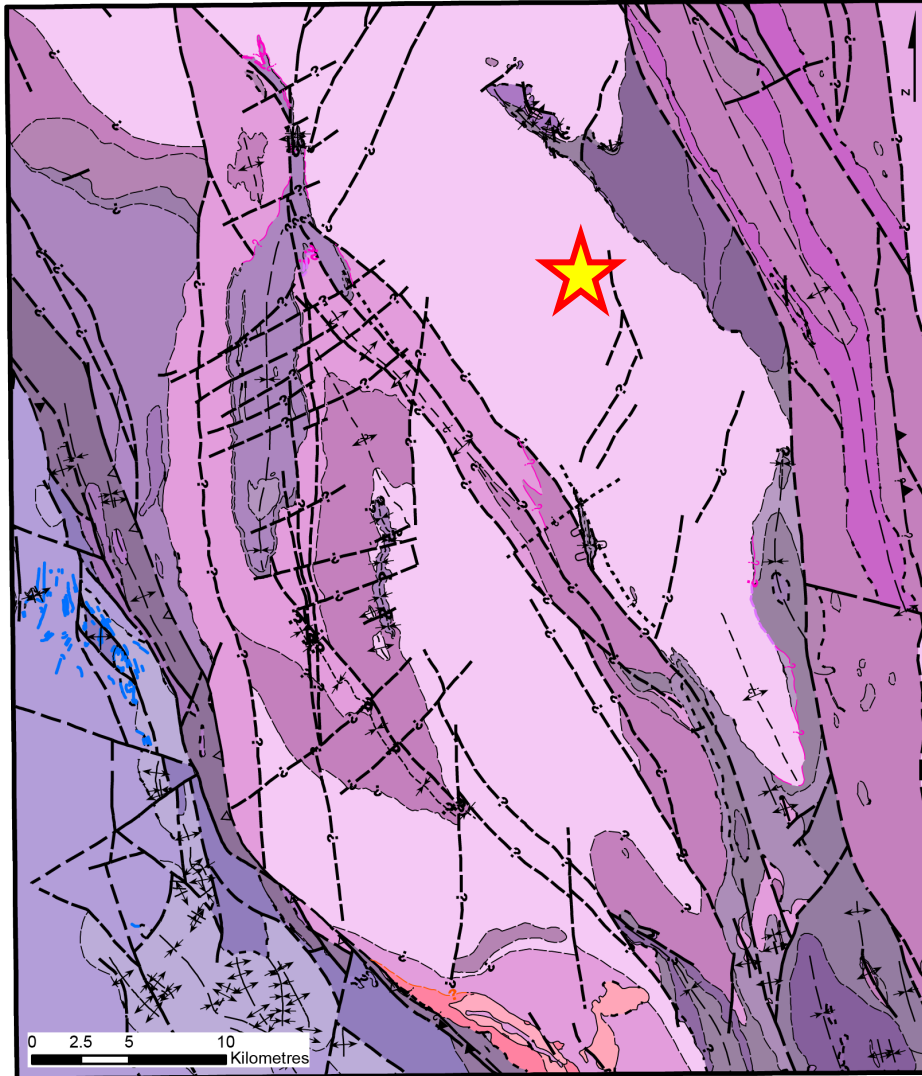
Benambran structure — geochronological evidence

Source: Fitzherbert, Simpson and Huang (2024)



- New apatite U–Pb LA-ICP-MS age of **506.3 ± 8.8 Ma** obtained from metagabbro sill in the **Narrama Formation** at Canbelego Cu mine
 - implies deposition of the Girilambone Group had commenced by the late Cambrian
- Requires that the lower stratigraphic levels of the **Girilambone Group** were **exhumed** prior to deposition of Kopyje Group
- Consistent with large-scale **Benambran-aged fold geometry**
- Corresponds with crustal-scale **antiformal reflector** imaged by Cobar–Yathong seismic survey

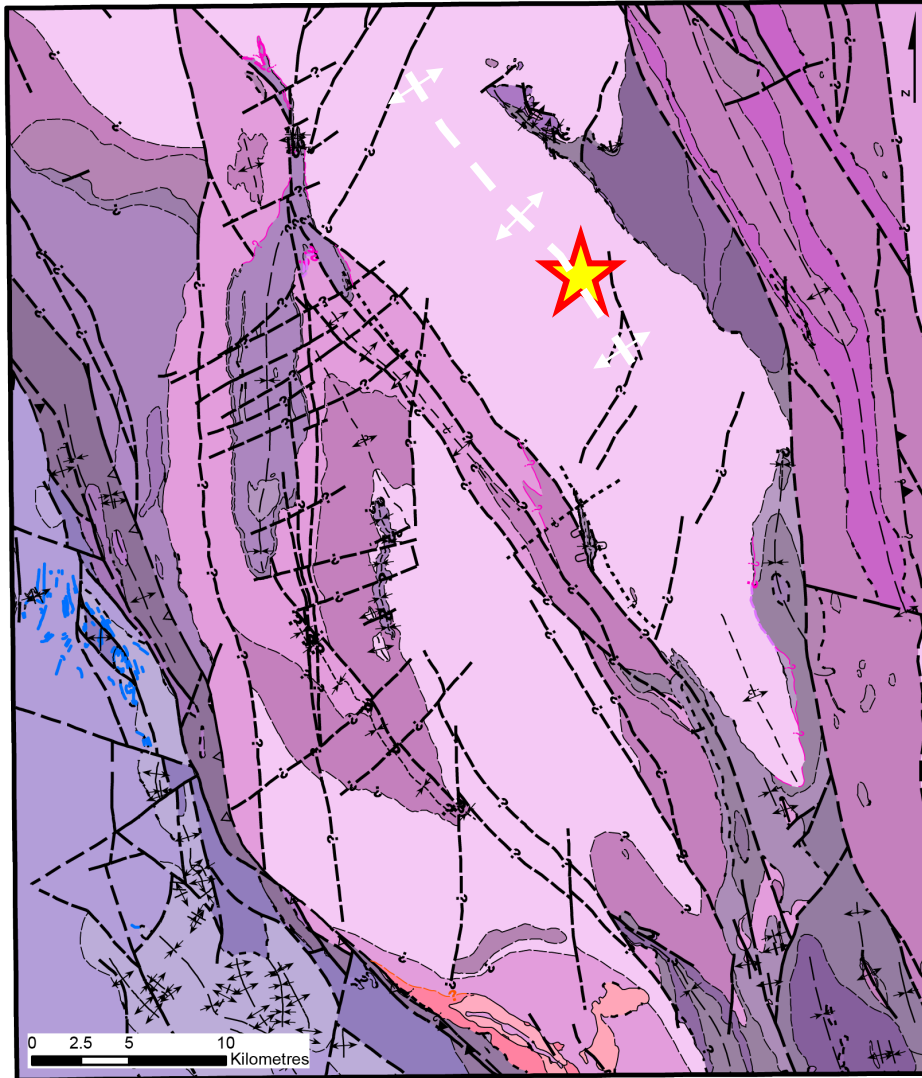
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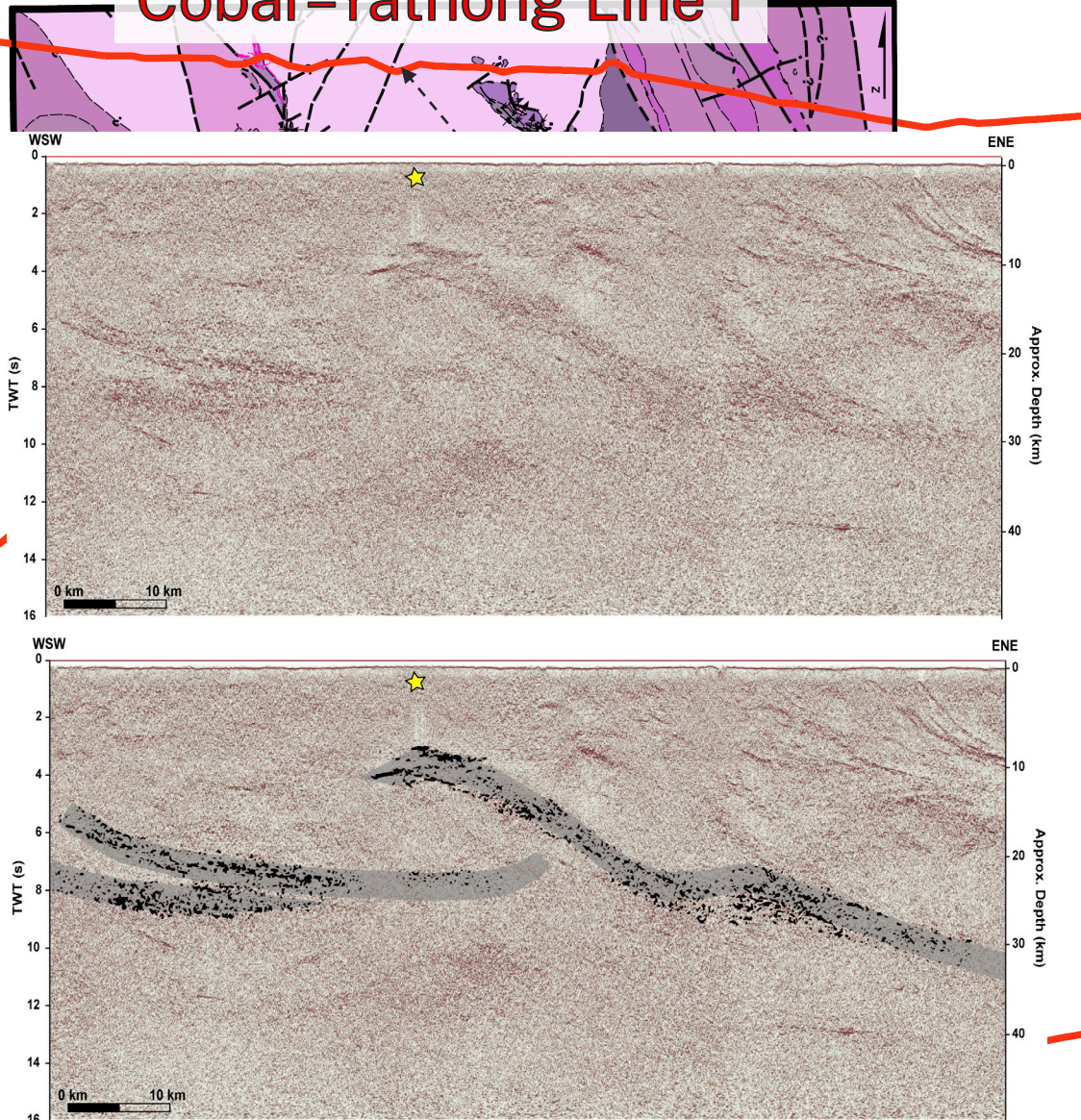


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Benambran structure – geochronological evidence

Cobar–Yathong Line 1



Seismic sections courtesy of Dr. Luke Mahoney

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- Multi-disciplined approach guiding a revised solid geology interpretation of the Canbelego 1:100 000 map sheet area:
 - providing improved geological context for the region's mineral deposits (e.g. Koree Syncline)
 - supporting current projects in the MinEx CRC – Cobar Focus Area
- Shows the distribution of stratigraphy is strongly influenced by two distinct fold-styles
 - Benambran: large-scale, long wavelength, high amplitude folds affecting the distribution of the Girilambone Group
 - Tabberabberan: small-scale, shorter wavelength and lower amplitude folds most influential on the Cobar Supergroup
- New apatite age of 506.3 ± 8.8 Ma obtained from metagabbro in the Narrama Formation
 - suggests **deposition** of the Girilambone Group commenced in the **Cambrian**
 - supports development of a large-scale fold geometry in the Girilambone Group during the Benambran Orogeny
 - consistent with crustal architecture imaged by the Cobar–Yathong seismic survey

Acknowledgements

- We thank Gordon Barnes and John Heavey at Helix Resources Limited for bringing the mafic rocks in the Narrama Formation to our attention and providing the samples for chemistry and dating
- Apatite geochronology was completed by Dr. Huiqing Huang at the Advanced Analytical Centre, James Cook University

